

MECHANICS' MAGAZINE,

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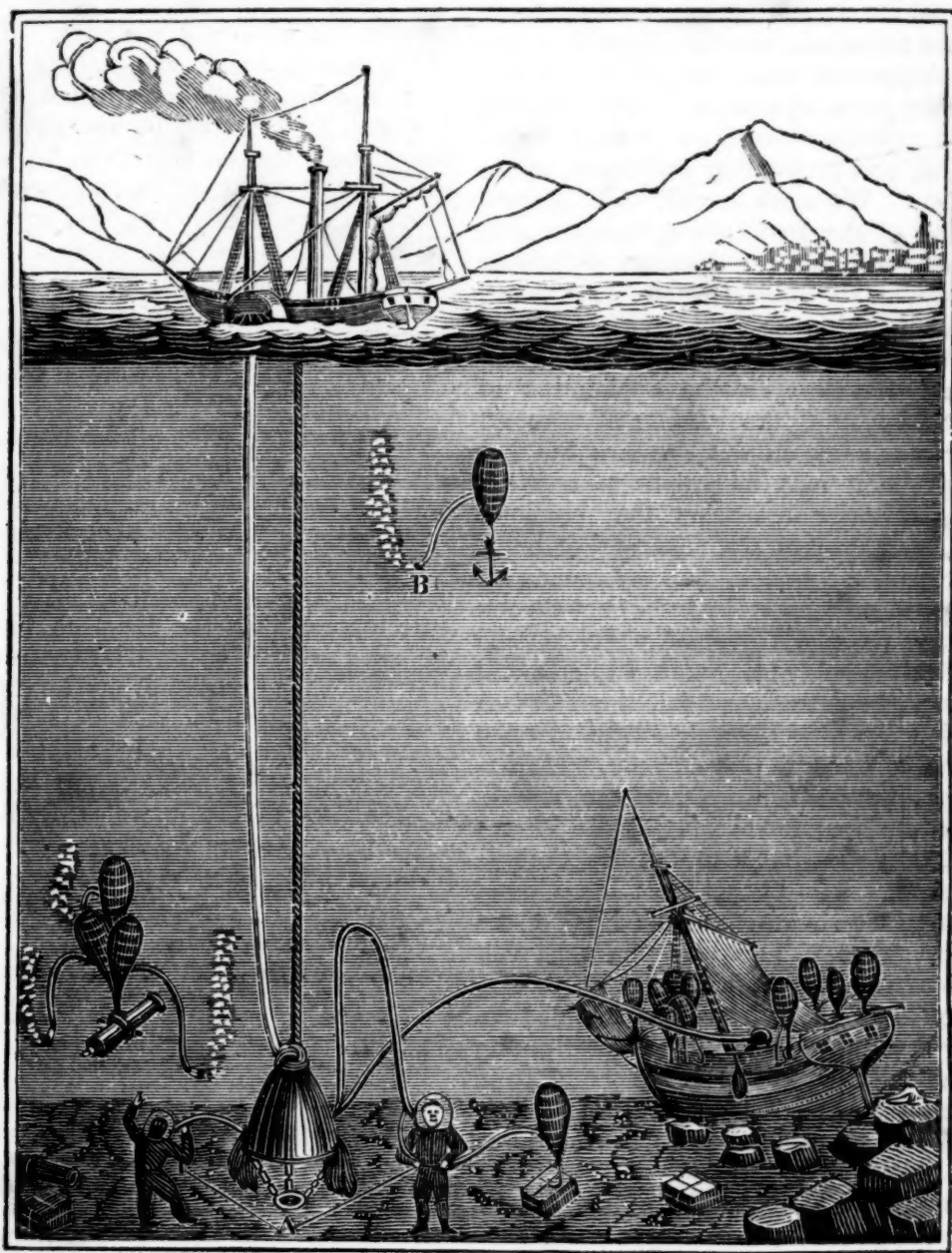
REGISTER OF INVENTIONS AND IMPROVEMENTS.

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[NUMBER 5.

Do not think learning in general is arrived at perfection, or that the knowledge of any particular subject in any science cannot be improved, merely because it has lain five hundred or a thousand years without improvement.—WATTS ON THE MIND.



Plan for raising Vessels sunk in Deep Water.

By Mr. JOHN MILNE, Teacher of Architectural and Mechanical Drawing, Edinburgh. [From the London Mechanics' Magazine.]

SIR,—Having read in a recent number of your Magazine, that Dr. Hancock has

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proposed the use of air as a power for raising goods, &c. from the bottom of the sea, I beg to forward to you a pamphlet of mine published in 1828, which contains, among other plans, two on this very principle. They attracted some share of attention at the time of publication, but neither of them has ever,

as far as I am aware, been carried into actual practice. Should you see cause, I shall be glad to find that you have drawn the attention of the public to this important but neglected subject. I am, respectfully, your obedient servant,

JOHN MILNE.

The pamphlet obligingly forwarded to us by Mr. Milne,* is entitled "Plans for the Floating Off of Stranded Vessels; and for raising those that have foundered; with an Improved Method of Carrying Vessels over Banks in Shallow Water." Of the two plans to which Mr. Milne more particularly invites our attention, one is adapted to the case of ships sunk near the shore, and the other to deep sea operations. Both are on the same principle—both exceedingly ingenious, and, in our humble judgment, quite practicable. We shall extract the author's description of the first at length, and beg to refer those who may be desirous of further information on the subject, to the work itself, which is altogether well deserving of perusal.

"I shall now describe the application of these air buoys,† to the raising of a vessel that has been sunk in deep water; but before doing so, it may be proper to mention the disadvantages attending the common practice. At present we pass one or more chains round the wreck, and by means of these chains suspend it by one, or between two floating vessels, a process which in deep water is attended with much expense and uncertainty, because no sufficient power can be applied from the floating vessel to raise the wreck at once to the surface. Moreover, from the great weight of the wreck, and from the manner of placing the chains about it, they are liable to cut the timbers of the ship, as in the case of the Comet steam-boat (see Narrative of the Loss of the Comet steamboat). The operators must wait till the lowest ebb of the tide, then, pulling up the ends of the suspending chains and securing them, the rising of the water acting upon the floating vessels, lifts the wreck from the bottom; and while the tide rises, they proceed with their load towards the land, until the suspended vessel again rests upon the bottom, by the water becoming less in depth. Hence, they cannot, during one flowing tide, raise the sunk vessel more than

the height to which the water had flowed from its lowest ebb, which at a maximum on the British coast does not exceed sixteen feet, and they must now suspend their exertions till the end of nearly twelve hours.

"Before that period arrives, however, a storm comes on, the workmen desist from their operations, and it not unfrequently happens, that before they can again commence their labors, the object of their toils has broken up, or has been imbedded in the sand.

"These inconveniences being obvious, I propose the following methods. The place of the wreck being ascertained by an improved drag, which at present I shall not describe, let her state be ascertained from a diving bell, and let there also be sent down with it a number of the before-mentioned buoys, in a perfectly collapsed state; and let the diving operator stow them away in that condition below decks, also hooking on as many about the ship as shall collectively be sufficient to buoy it up when inflated; for their inflation let him insert a small copper tube, which is attached to a leathern pipe,* into the nozzle of each of the buoys (see engraving, fig. A), which pipe, communicating with the air within the diving bell (air being forced down into the steam-vessel†), will also inject air into the buoys, if they be held up, at the commencement of filling, a little higher than the level of the water at the mouth of the bell.‡ Or these envelopes may be speedily filled, by letting down a number of metallic vessels, charged with thirty or more atmospheres, which being discharged will quickly inflate them at the convenience of the operator, by his turning a common stop-cock, which, in either of these methods, is all he has to do.

"Having, by one or other, or by both of these methods, filled a sufficient number of buoys, the wreck will begin to rise whenever the bags have displaced that bulk of water which is equal to the weight of the wreck while immersed in the same fluid. Let the

* This pipe should be sufficiently long to admit of the operator hooking on other buoys, while one bag is in the act of being filled with air.

† To be stationed over the sunken ship, (as explained in a preceding section of the pamphlet,) and provided with an air-compressing pump and a common blowing pump.—[Ed. L. M. M.]

‡ Even the azotic gas discharged by the operators might be employed for this purpose; the quantity of common air deteriorated by them being very considerable. Pepys and Allen, in their Essays on Respiration, state that an easy inspiration is about 16 cubic inches, and that the subject of their experiments made about 19 of these per minute; for which it can be shown by calculation, that four men would discharge from their lungs, in one hour, a volume of air having a buoyant power equal to 2702.08 lbs. avoirdupois, or thereby.

* Author of the excellent "Practical View of the Steam Engine."

† "Leathern bags, well sewed and tanned or barked in the best manner"—"made nearly air-tight, and proof against the attacks of vermin." [p. 5.] Mr. Milne, in a manuscript note on this passage, in our copy of the pamphlet, says: "Open-mouthed vessels of tin-plate would be preferable, to be inverted when in use, and packed into each other when not in use."—[Ed. L. M. M.]

weight to be raised from a depth of 65 feet be 300 tons avoirdupois, = 672,000 lbs. $\div 64$ lbs., the medium weight of a cubic foot of sea water, = the buoyant effect of 10,500 cubic feet of air discharged from the diving bell at that depth.

"But by using air previously compressed to thirty atmospheres, and discharged at the same depth, and by allowing the capacity of each vessel so charged to be $2\frac{1}{2}$ feet, then $27^* \times 2\frac{1}{2} = 67\frac{1}{2}$ cubic feet of air discharged from one compressed vessel, $\times 64$ lbs., the buoyant effect of one foot of air in sea water, = 4,320 lbs. buoyant effect of air originally compressed into one vessel; but the load to be raised was 672,000 lbs., therefore, $\div 4,320$ lbs., = 155.5, &c. compressed air vessels, allowing the apparatus to have no weight of itself. I would also propose the use of such leather buoys for giving expedition to common diving bell operations, in bringing all kinds of goods, cannon, anchors, &c. from the bottom; and also for clearing such rivers as the Tay, below the town of Perth, and many such places, where navigation and the salmon fishing are greatly impeded by large stones at the bottom of the river. The stones might be Lewis'd† at low water, or they might be bored from a diving bell, the collapsed buoys made fast, and at convenience they could be inflated from a boat by a common forcing pump; the stones being suspended in the water may be towed to any place for the purpose of embanking, where they could be instantly sunk by pulling up the end of the escape pipe, B; the more immediate use of which pipe is to allow the superabundance of air to escape, which, while at the bottom of the sea, is compressed by the hydrostatic action of the surrounding medium; but immediately when the envelope begins to ascend with its load, the pressure of the water becomes less, and in the same proportion will the air expand within these bags, and ultimately would burst them, were it not that this pipe allows it to escape. It should be about nine feet long, having its lower end weighed down by a nose of metal, from which the air will al-

ways be retained within the bags till its expansive force becomes more than the pressure of water at the under orifice of this escape-pipe. Indeed, the maximum expansive force of air within its envelope may always be known by the length of this pipe B. Such an escape pipe must also be attached to each of the buoys employed in raising the wreck from the bottom of the sea. I shall only remark, that it would not be necessary for these buoys to be absolutely air tight, because they may be kept sufficiently full by the method already pointed out. Nor would there be any chance of their bursting by their buoyant power, which could never exceed the weight of their bulk, and they would require to be just as strong as to be capable of retaining water without bursting when filled with it, and suspended by their hooks from a pin in the wall. I would also propose the use of these buoys for floating the large stones which are used in forming sea-fences or dykes; the stones are usually carted from low water mark, but the method here proposed would be less expensive."

On the Construction of Diving Bells. By S. D. To the Editor of the Mechanics' Magazine and Register of Inventions and Improvements.

SIR,—In the construction of the common diving-bell, an instrument now very extensively and importantly used, a complication of pulleys, barrels, and ropes, always liable to accident and interruption, is necessary to insure a supply of pure air to the person in the bell, and to remove the impure air constantly generating. It has struck me sometimes—although from its not having been already adopted, there probably exists some insuperable objection to the proposal, which I do not perceive—that a condensing syringe might be used with great advantage. This syringe might work into a small reservoir above water, from which the communication (a well-constructed hose would serve every purpose) would proceed to the bell; this hose, it is evident, might be of any length, coiled even while in use on the deck of the lighter, which always accompanies the bell, and connecting by means of an opening in the top of the bell, to which might be attached a stop-cock, by which the person inside would always be enabled to govern the supply. For the removal of the impure air, a second set of hose should connect with a second stop-cock; the upper mouth of this set would be in immediate communication with the atmosphere, while the condensing syringe above was supplying the

* The air-buoys being at a depth of 65 feet, would be compressed by the water with a force equal to the weight of two atmospheres.

† A Lewis consists of three bars of iron, which are square on their section, when cut at right angles to their sides; these being placed side by side, form something like a dove-tail tenon; a corresponding mortice is cut in the stone to be raised, and the two outside bars are first placed within this aperture; the centre bar being throughout of equal thickness, is next placed between them, and a bolt with a clutch-ring is passed through the heads of all the three, by which the stones may be suspended. This instrument has long been in use, and is almost indispensable in a massive building.

bell with additional air, and thereby expelling from it additional water, the person inside would occasionally, at his discretion, open this second stop-cock, and allow a portion of the impure air to escape, which would be immediately replaced by pure air from the first set of hose, and thus a current of air might be created apparently more perfect, and attended with much less trouble than by the methods in present use. A sketch would more readily explain the simplicity of the mode; but a sketch requires a wood cut, and while doubting whether the idea is not open to some peculiar objection, I have not troubled you with one.

Very respectfully, Sir, S. D.

Boston, April 21, 1834.

On the Color of the Air and of Deep Waters, and on some other Analogous Fugitive Colors. By COUNT XAVIER DE MAISTRE. Translated from the Bib. Univ. by Prof. J. Griscom. [From the American Journal of Science and Arts.]

The blue color of the sky is accounted for, by supposing that the sun's light, reflected by the surface of the earth, is not entirely transmitted by the atmosphere and lost in space, but that the molecules of air reflect and disperse the blue ray. Why this ray is reflected in preference to the indigo and violet, which are more refrangible, and appear to be more easily reflected, is a circumstance not accounted for.

The same blue reflection is observed in deep sea water, and in lakes, and rivers, when they are limpid.

The same singular phenomenon is also witnessed in various substances of different natures, which have no apparent analogy: thus, opaline substances are blue by reflection; the noble opal, (independently of the partial rays which give so high a value to this stone, and which are attributed to natural fissures,*) reflects a general blue color, which is also observed in some other siliceous stones, and which is still more obvious in opaline glass. A weak solution of soap is slightly blue; the jelly of ichthyocolla is more so, and an infusion of the bark of the large chesnut tree, (*maronnier*), which is perfectly opaline, still more. Newton speaks of a wood which he calls nephritic, the infusion of which is opaline. In the Sicilian sea, at the mouth of the Giaretta, (the ancient Simethus,) specimens of amber are found which are in great request on account of their highly opaline properties.

A blue reflection is also observed in certain bodies which are opaque-white when reduced to plates thin enough to transmit light. A familiar example occurs in the skin covering the veins, which transmits a blue, although neither the skin nor the blood is of that color.

The mixture of white with black and with transparent colors gives in painting numerous examples of opaline blue.

This blue color is the only one which can be explained on the theory of thin plates, by supposing that the particles of opaline bodies have just the dimensions requisite to reflect the blue ray. This explanation derives some probability from observing that the color transmitted by these bodies is the complementary yellow of the reflected blue. This theory, however, presents great difficulties, and it is not intended absolutely to admit it in this essay.

The analogy between the colors of opaline substances and those observed in the air and waters, will become obvious by an examination of their action on reflected and transmitted light, proving that the phenomena are owing to the same cause.

Opaline glass is produced by mingling in the common metal of white glass a portion of calcined bones, which gives a blue shade without much impairing the transparency. The bone powder appears to be in a state of extreme division, or a kind of demi-solution, which does not disperse the transmitted light.

The color of the light transmitted by opaline bodies varies according to the volume of the mass; it is yellow if the body is thin, and becomes successively orange and red in proportion to the increase of thickness. The analogy of the air with opaline substances is not only manifest in the blue reflection, but also in its action on transmitted light, which becomes successively yellow, orange, and red, according to the volume of air and the kind of aqueous vapors with which it is impregnated. When the sun is high, and his light crosses only the purest and thinnest portions of the atmosphere to reach the clouds, they are white, with a slight tinge of yellow; they become sometimes yellow and orange as the sun declines; and at length red and purple when his light grazes the earth, and is transmitted by the densest portion of the air, and loaded with the vapors of the evening.

But it often happens that the colors do not appear, and that the sun sets without producing them. It is not, therefore, to the purity of the air alone that we must attribute the opaline property of the atmosphere, but to the mixture of air and vapor mingled

* This was the opinion of the celebrated Haüy.

in a special manner, and producing an effect similar to bone dust in opaline glass; neither is it the quantity of water in the air which occasions the colors, for when the weather is very damp it is more transparent than during a time of drought. Distant mountains are seen more distinctly, a well known prognostic of rain; the sun then sets without producing colors, it looks white through the fog and damp vapors of the morning, but when the clouds are colored red by the setting sun, the phenomenon is generally deemed the signal of fine weather, because these colors are a proof of the dryness of the air when these contain only the peculiar diffused vapors which give it its opaline quality. In this state of things the disc of the sun appears like a red fiery globe divested of rays.

The blueness of the sky, therefore, varies according to the kind of vapor which is spread through the air; and what renders it unquestionable that its blue color is caused by these vapors is, that it appears black when seen from the highest points of the globe, above which there is not sufficient vapor to reflect the blue color.

Limpid waters, when they have sufficient depth, reflect like air a blue color from below; it is of a deeper shade, because it is not mixed with white light; very often it is not perceived at all; the reflection from the surface, on which the sky and surrounding objects are painted as in a mirror, often occasions the disappearance of the internal reflection, or forms with it complex shades.

We have seen that the property which air possesses of producing colors is derived from the presence of watery vapor; analogy leads us to presume that this property in water arises from a mixture of air which it always contains to a greater or less amount.

Although the blue color of water is often masked by numerous causes, it is sometimes exhibited in all its intensity; a fine example of it is witnessed in looking at the Rhone from the bridge at Geneva. The river seems to flow from an ultramarine* source. The spectator is in the most favorable situation for observing the internal reflection disengaged, as much as possible under an open sky, from the reflection at the surface.

Agitation of the surface has a great effect on the color. A tranquil sea sometimes reflects the warm color of the horizon, representing all the tints of a luminous sky so exactly, that the sky and sea appear to be blended with each other; but if a gentle breeze ruffles the surface, the brilliant tints

vanish, and the blue from the interior immediately predominates.

Such is also the cause which enables one to distinguish the course of the Rhone far into the waters of the Leman: the progressive motion of the river in the motionless water of the lake produces an agitation which diminishes the brilliant reflection of the sky and renders the color of the water more sensible.

The green tint which the sea often assumes may seem to throw some doubt on this property of reflecting the blue ray, regarded as inherent in the nature of water; but this green color is observable only when the depth of the sea is insufficient, that is, when the bottom may reflect the transmitted light.

In looking at the sea from an elevation of about fifty toises, on the shore of the island of Capri, I observed spots which were of the finest green, much more luminous than the dark blue sea with which they were surrounded. To ascertain the cause, I took a boat and proceeded to the place. The spots then were no longer perceptible, but I soon re-discovered them, and found that the color was occasioned by white rocks, which were easily distinguished, notwithstanding their great depth, from the dark sandy bottom in which they reposed. These rocks, viewed in a vertical direction, were of a lighter green than when seen from the height, but I could not doubt that they were the cause of the phenomenon.

To settle the point by direct experiment, I prepared a square sheet of tinned iron, fourteen inches long, painted it white on one side, suspended it horizontally to a cord, and sunk it in a deep place, where the water under the boat was blue, without any mixture of green, watching the effect under the shade of an umbrella which was held over my head. At the depth of twenty-five feet it acquired a very sensible green tinge, and this color became more and more intense to the depth of forty feet, when it was of a beautiful green, inclining to yellow; at sixty feet the color was the same, but of a darker shade, and the square figure of the plate was no longer distinguishable; until at eighty feet there was apparent only an uncertain glimmering of green, which soon disappeared.

We thus perceive that the light of the sun transmitted through water, and reflected from a white surface, produces green. The cause may be readily conceived by admitting in deep waters the same opaline property which we recognize in air. The light, after penetrating a mass of one hundred feet of water, to reach the plate and return to the

* Having the blue color of the ultramarine paint.

surface, ought to be yellow, like that which would be transmitted by an opaline fluid; this color reflected by the plate, mixed with the blue which reaches the eye from all quarters, produces the green. If the bottom of the sea were white, like ceruse, the waters near the shore would present the same green tint which the plate produced at different depths; but the bottom is generally of a dark grey, which reflects less light, and therefore yields only a dark and uncertain green: hence the green color of the sea, as witnessed near the shore, is owing to the reflection of light from its bottom. To leave no room for doubt in this matter, I took a boat and pushed out from the shore, under a clear July sun, at eleven in the morning, to examine the changes which might be perceptible in the color of the water viewed on the side of the boat opposite to the sun.

At fifty toises from the shore the water was decidedly green, the shade of which remained during fifteen minutes; it then became a bluish green, and, in advancing, the blue continued to increase, and at length to predominate, and in an hour's time the water under the boat was a pure blue without a mixture of green.

In returning to the shore I was attentive to the re-appearance of the green, and as soon as I found it clearly marked I sounded and found the depth one hundred and fifty feet; thus the light which renders the sea of a green color passes through three hundred feet of water. But in that part of the gulf another cause contributed to the green color, viz. the impurity of the water as it exists to the extent of some miles from the shore. The bay of Naples receives no river that can give motion to the waters charged with all the filth of that populous city. On the shore of the islands of Capri the water is perfectly blue at eighty feet, while near Naples it requires one hundred and fifty feet, a difference which must be ascribed to the impurity of the water in the bay.

If the bottom be of a black, or very dark color, the water may be blue at a much less depth than eighty feet. Besides, if an obstacle intercept the direct rays of the sun, so as to throw a shade over the bottom, while the water itself is illuminated, the latter will be blue, because no longer colored by yellow rays from the bottom; this effect may take place near shore in deep waters, by projecting cliffs or high shores.

It is thus ascertained, that when the sun's light transmitted through water is not lost in its depth, but is partially reflected by the bottom, the water is of a green color.

This effect may arise in deep water from

beds of submarine plants, or by myriads of microscopic mollusca, which, covering a vast extent of sea, may act upon the light, or even exist in mass sufficient to produce a permanent color.*

The colors transmitted by deep waters cannot be directly observed like those of air, which are visible among the clouds; observations agree on this point. The learned Halley, in descending in a diving bell, observed that a ray of light, which reached him through a small opening closed by glass, gave to the upper part of his hand a rose color. Had his hand been white, instead of being itself more or less red, the experiment would have been more conclusive. The depth to which he descended was probably not more than thirty or forty feet, at which the transmitted light could not differ much from yellow, which, mixed with shades of white, and with the natural color of his hand, would produce a rosy tint. He observed that the under part of his hand was green, which must have been occasioned by reflection from the bottom.

The bluish green color of crevices in the glaciers is occasioned in the same manner as that of water near shore; if the mass of ice was as great and as homogeneous as that of the sea, the interior of the crevices would be blue; but the ice contains air bubbles, particles of snow, and fissures which reflect the transmitted light, throwing it from one face to another of the crevice until it finds an escape. These opaque substances in the glacier produce the same effect as a white surface in the depths of the sea.

There is on the shore of Capri a grotto, which nature seems to have constructed to exhibit in all its beauty the green color of the sea, and which on this account is called the *azure grotto*; it is situated under a cliff on the north side of the island. As it could not be entered by a common boat, it remained unknown until 1826, when two Prussian artists, Kopitch, and Frisi, swam into it, and made it known. Their account excited public curiosity, and boats of convenient size were made, which now serve to introduce amateurs. Its entrance is triangular, having a base of four feet five inches wide and about the same height. The summit is rounded, and having but little thickness the entrance is easily effected by stooping, when the traveller finds himself in a spacious grotto, the sides and roof of which

* The theory of the author derives confirmation from the beautifully green appearance of large fish as they turn upon their backs in rising towards the surface, and sporting round a ship, during her passage through a dark blue sea.—[Trans.]

are remarkably regular. Its extent from the front to the rear, which is the only landing place, is one hundred and twenty-five feet, and it measures one hundred and forty-five feet in a transverse direction. The depth of the water at the entrance is sixty-seven feet, in the middle of the grotto sixty-two feet, and at the landing place fifty-eight feet. The rock is limestone, of a clear grey fracture, and there are no indications of stratification.

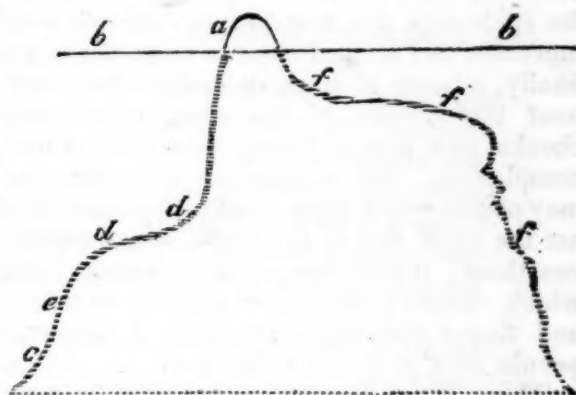
On entering, every thing appears dark except the water, which is luminous, and of a splendid blue, contrasting with the general obscurity. In advancing from the entrance, the ends of the white oars shine in the water with a splendid blue light, which disappears as soon as they are raised: this is the most singular phenomenon of the azure grotto, for people are puzzled to conceive why objects are so vividly luminous in the water, and no longer so when above the surface. In dipping the hand or a cloth into the water, one would think it a blue dye; the whole immersed part is luminous and colored, while the parts without are dark and uncolored.

At the bottom of the grotto there is a small space on a level with the water, where debarkation is effected, and which is the only spot which leads to any suspicion of the work of human hands in the grotto. It is a kind of bench in the rock, about three feet high, on which several persons may conveniently place themselves and examine at leisure the phenomenon of the azure grotto. The light, which comes in at the small opening, produces a train of white light, like the reflection of the moon from the water when rising, and which extends half way over the sheet. The rest of the surface is blue, even to the feet of the observer. This color gradually diminishes to the right, where the walls of the grotto are farther from the entrance. The train of white light illuminates also the vault, and exhibits it in its natural color, but when the entrance is closed by a boat, or more perfectly by a dark cloth, the vault itself becomes blue, reminding one of the effect of burning spirits of wine in a dark chamber. There is, then, no light but that which proceeds from the water. The experiment of the cloth ought to be made by all who wish to enjoy the spectacle in its full beauty.

If, when the observer is seated on the bench, a boat passes in front, it forms no reflection nor shade in the water. If the eyes are then covered with the hands, so as to hide the boat and the water, the former appears suspended in the air like a dark silhouette crossing the sky. This spectacle is

so striking when first observed, that one cannot avoid some apprehension on account of those who furnish the occasion of it. In passing to the dark side mentioned on the right, the water is no longer blue, but remarkably transparent. The rock below is so illuminated as to show its fissures at a considerable depth, while above the water it is very obscure. The water line is clearly marked, and has a yellowish tint. The depth seems to increase the longer it is observed, and at length the bottom is seen, although forty feet below. The white plate which I let down was very distinguishable on the darker sand. Its color, instead of being green, as when tried in the sun, was slightly yellow.

The feeble yellow light which illuminates the submarine walls in this part of the grotto, proceeds by reflection from the bottom, and from the walls opposite, which receive the exterior light; this light, which has traversed a great mass of water, should be yellow, like that transmitted by opaline fluids, and thus the opaline quality of the sea affords a satisfactory explanation of the principal phenomena of the grotto. I have endeavored to give an idea of this construction by means of the subjoined figure, which represents the exterior rock or shell of the grotto, as it exists both in the sea and above the surface.



The little entrance is shown at *a*, above the level of the sea, represented by the line *b b*. The eastern side of this entrance extends almost perpendicularly to the depth of thirty or forty feet, when it appears to be cut horizontally at *d d*, and suspended on the dark blue water of the sea; *d e c* is the supposed continuation of the eastern side of the entrance, to the bottom, which, as we have seen, is sixty-seven feet deep. The western side of the entrance, *f f f*, forms an angle at ten or twelve feet below the surface, and is prolonged horizontally from twenty to twenty-five feet, and then descends

obliquely, probably to the bottom of the sea, where it cannot be seen beyond thirty or forty feet.

This construction gives an immense opening for the light to enter the grotto through the water, even when the little opening above the surface is closed, and it thus occasions, over a great mass of water, that dispersion of the blue ray which always takes place in deep and limpid waters, and which is manifested in greater splendor in the azure grotto in consequence of its being mingled with no other light.

Having considered the opaline property of air and water, let us now examine the production of opaline blue in opaque bodies.

The cause of the blue tint assumed by the fine skin which covers the veins has hitherto been a doubtful question. This phenomenon, which is uniformly connected with the opaline property of the skin, is mentioned by Leonard De Vinci; let us first see the conditions under which it exists.

First, the vein must be deep enough to absorb all the light transmitted by the skin; and the skin must have the thinness requisite to transmit a great portion of the light. If the vein is thin, it reflects the color of the blood and becomes red;* this color, mixing with the opaline blue of the skin, forms those violaceous tints observable on the countenances of persons of dark complexion (*brouille*). If the vein is still thinner and nearer the epidermis, the transparency of the skin increases and the red color is more distinct; finally, a tissue of imperceptible veins, very near the surface of the skin, colors the cheeks and lips of young people of a fine complexion, with a uniform red; but we may observe that these beautiful colors have not the exact tint of the blood which produces them; it partakes of the opaline blue, which renders the color slightly carmine, and tinges sometimes the lips of sanguine people of a purple or violet hue.

Thus, the difference which may exist in the size of the blood vessels, and in their proximity to the surface, is sufficient to produce all the shades of blue, violet, red and purple, which are seen in the human face, by the mixture of the opaline blue of the skin with the red of the blood.

The red color of the blood is not the cause of the blue tinge of the veins; it might be black or green without occasioning any change; it is enough that the coloring principle absorbs all the light transmitted by the skin. This result may be artificially pro-

duced by a very thin plate of ivory, which has nearly the same effect as the skin. If a few drops of ivory black, prussian blue, cochineal, or bile, sufficiently dense to be opaque, be placed on one of its surfaces, they produce alike a blue tint on the opposite surface, because they equally absorb all the light transmitted by the ivory. But if, instead of a coloring matter which absorbs light, we use an opaque reflecting coloring substance, we have a tint compounded of opaline blue and that of the color employed.

The red oxide of lead placed on the ivory gives on the opposite surface a slight tinge of carmine. Some painters avail themselves of this property of ivory, in sketching the cheeks and lips of their portraits, by placing a coat of minium on the opposite surface, and thus obtain indirectly the effect of a slight use of carmine.

But if, instead of minium, Naples yellow be put on, there is on the opposite surface a green spot. In both these cases, then, the opaline blue is mingled with the proper tint of the opaque reflecting color, while the blue alone appears when the applied color absorbs the light transmitted by the ivory.

The mixing of colors in oil painting furnishes still more evidently an opaline blue. The most common case is the mixture of white with vegetable black, which produces a bluish shade. Various writers have adverted to this, and as indigo and prussian blue, in mass, approximate to black, it was thought in former days that blue was a mixture of light and shade; but the blue produced on this occasion belongs exclusively to white and not to black, as is proved by the following process: two plates are painted of a grey color, one by a mixture of ceruse and charcoal ground in oil, the other by superadding to a coat of white a glazing of charcoal, so that they may both have the same depth of shade; the first will be bluish, the second grey, without a mixture of blue.

As transparent colors in oil lose almost wholly the color which they have in a pulverulent state, and thus in mass approach to black, the mixture of them with white produces also opaline blue, which modifies the natural shade of the color.

Every painter knows the striking difference there is between the color of a mixture of cochineal lacker with white, and that which the same lacker produces as a thin coating upon a white ground; the first is of a violet color, and the second has all the purity and splendor which is characteristic of this fine color. Thus artists, who wish to obtain the beautiful red of cochineal or madder in their draperies, always employ these lack-

* It is thus that a wide barometer tube, filled with colored wine, appears black, while a thin thermometer tube, under like circumstances, is of a beautiful purple.

ers in mixture (*en glacis*). Opake reflecting colors, such as Naples yellow, chromate of lead, yellow ochre, produce, as well as white lead, opaline blue, by a mixture with black, and the effect is still more sensible. These compounds, according to theory, ought to give only shades of yellow; and yet their tints are decidedly green, so that they are often used for painting the deepest verdure of landscapes. In these cases it is the opake reflecting color which is opaline.

I have stated the most remarkable instances of the singular property which certain colors possess of producing opaline blue by mixture, but there is an infinite number of other modifications less apparent, resulting from mixtures of compound colors, which it would be impossible to describe, but which may always be pre-ascertained by the following rule: *When white lead or opake reflecting colors are mixed with black, or with transparent colors, there is a production of blue, and a consequent modification of the primitive shade of the coloring matter.*

These modifications are often very slight, but they do not escape attentive observers. In the preceding observations I have described effects, well known, it is true, but which appear to have no analogy to each other, and which appear to me to depend wholly on the peculiar property which the blue ray possesses of being reflected, in preference to other rays more or less refrangible, by the simple mechanical resistance of the molecules of bodies which transmit light. This resistance takes place in large masses of transparent fluids, as in air mixed with watery vapor, and in water mixed with air.

It takes place also in opake bodies which are less transparent, but under smaller dimensions. Lastly, it is observed in white opake or colored bodies, as in the fine skin which covers the veins, and in mixtures of colors.

A Compendium of Civil Architecture, arranged in Questions and Answers, with Notes, embracing History, the Classics, and the Early Arts, &c. By ROBERT BRINDLEY, Architect, Surveyor, and Engineer. [Continued from page 206.]

PERPENDICULAR ENGLISH STYLE.

Q. What is to be advanced on this style?

A. At the close of the fourteenth century, flowing lines gave way to perpendicular and horizontal ones.

Q. How long does the perpendicular style appear to have been in use?

A. As far as 1630 or 1640; but only in additions. Probably the latest is not later

than Henry VIII., on account of the gradual introduction of Italian architecture.

Q. What distinction is marked in the doors from the former style?

A. The constant square head over the arch, which is surrounded by the outer moulding of the architrave, and the spandrill filled with some ornament, and over all a dripstone is placed. In large rich doors a canopy is sometimes included in this square head, and sometimes niches are added at the sides, as at King's College chapel, Cambridge. The shafts are small, and have plain capitals, oftener octagonal, and the bases made so below the first astragal. The architraves consist of ogee mouldings.

Q. How are the windows distinguished?

A. Very easily—by the mullions running in perpendicular lines, and the transoms, which are now general. The varieties of the last style were in the disposition of the principal lines of the tracery—in this style, in the disposition of minute parts. A window of four or more lights is divided into two or three parts, by stronger mullions running up, and the portion of arch between them doubled from the centre of the side division. In large windows the centre one is again made an arch. Often, in windows of seven or nine lights, the arches spring across, making two, four, or five lights in the centre belonging to each.

Q. How are the heads of the windows described?

A. Instead of being filled with flowing ramifications, they have slender mullions running from the heads of the lights, between each principal mullion; and these have small transoms. The entire window is divided into a series of small panels—the heads being arched are trefoiled or cinquefoiled.

Q. What also is peculiar in the buildings of this era?

A. The window and its architrave completely fill up the space between the buttresses. The east and west windows are very large. St. George's, Windsor, has fifteen lights in three divisions. The east window at Gloucester is also very large.

Q. Of what character are the arches?

A. The four-centred is much used, but varying amongst the ornamental part of niches. The arches, used in the division of the aisles, form a great distinction in this style, by the constant use of mouldings running from the base all round the arch, without any stop horizontally, by way of capital—sometimes with one shaft and capital, and the rest of the lines running. In window arches shafts are seldom used; the archi-

traves run all round, and all the arches are enclosed in squares with ornamental span-drills.

Q. What is another distinction of these arches?

A. In large churches, the absence of the triforium between the arches of the nave and the clerestory windows. The place is supplied by panels, as at St. George's, Windsor, and Henry VII.'s chapel.

Q. Of what description are the piers?

A. In this style they are thinner between the arches than the former, and the proportion the other way, from the nave to the aisle, increased by having those shafts which run to the roof, to support the springing of the groins, added in front, and not forming part of the mouldings of the arch, with a bold hollow between them, as at King's College chapel, Cambridge; St. George's Windsor; and Henry VII.'s chapel. In small churches, the pier of four shafts and four hollows is much used.

Q. What variation is there in the buttresses?

A. Triangular heads are less used in the stages. Pinnacles are freely adopted; the whole differing but little from the last style.

Q. What of the cornices?

A. They are composed of many mouldings, ornamented with flowers and grotesque animals, similar to the preceding style; the dripstones are also the same.

Q. Describe the niches.

A. They are numerous: simple recesses having ogee canopies; others overhanging square headed canopies.

Q. What of the ornaments?

A. They consist in panelling in one general series. King's College chapel, Cambridge, St. George's, Windsor, and Henry VII.'s chapel, illustrate them. Another peculiar ornament is the angle-cornice, as at Windsor, and Henry VII.'s chapel. Crockets were formed in this style; those of pinnacles were much projected.

Q. What may be said of the steeples?

A. They possess little variation from the earlier dates.

BATTELEMENTS.

Q. What descriptions of battlements are there?

A. The Norman; which appears to have been a plain parapet. An ornamental parapet continued to be used through the following styles, but with the frequent use of battlements, of several sorts, both plain and pierced; even towards the perpendicular style, it continued with less alterations than any other parts.

Q. Of what character is the most frequent early pierced parapet?

A. It is a series of interchanged trefoils, with a serpentine line separating them, and mostly used in decorated English buildings. In the perpendicular, the dividing line is straight, making a series of interchanged triangles. The early pierced battlements have quatrefoils, with a cap-moulding running round. There are also pierced battlements, not with straight tops, but variously ornamented. The tudor flower is also used as such.

Q. Of what description are the plain battlements?

A. Several: 1st, that of nearly equal distances, with capping round the outline; 2d, the castellated battlement of nearly equal intervals—the cap-moulding running horizontally; 3d, a battlement similar to the last, but the mouldings running quite round; 4th, a battlement with cap-moulding broad—of several mouldings, and running round the outline, narrowing the intervals, and enclosing the battlements.

ROOFS.

Q. How may the roofs be divided?

A. Into two divisions: 1st, the sloped framing, carrying the lead visibly; 2d, the inner roof of different materials.

Q. What of the Norman roof?

A. This was quite plain. The only original one is in Rochester cathedral.

Q. Where is a specimen of the ornamented open roof?

A. At St. Stephen's.

Q. What of the inner divisions of roofs?

A. They vary: the first described is flat over the ties, planked, and painted, as at St. Albans.

Q. What is the next description of roof?

A. The regular groined roof, of which we have a series, from the plain Norman arched to the pendant roof of Henry VII.'s chapel.

Q. What afford a good description of roofs?

A. The Norman crypts: the first to be noticed has four cross springers, without straight ribs, from the opposite piers; the next is the plain rib, running longitudinally at the top, crossing the ribs from the piers, and also the intersection of the cross springers; another rib runs crosswise at the top of the window-arches, crossing the centre intersection.

Q. What is the next description?

A. The fan-tracery. In these roofs, from the top of the shaft, springs a small fan of ribs, without doubling out from the points of the panels—ramifying on the top; and a

quarter or half-circular rib forms the fan : and the lozenge interval is formed by some of the ribs of the fan running through it, and dividing it into portions filled with ornaments. King's College chapel, Cambridge, Henry VII.'s chapel, the Abbey church, at Bath, and Gloucester cloisters, are fine specimens.

Q. What of the arched roof?

A. It is used in small chapels. The roof of the nave of Bath is a beautiful illustration. The arch is very flat—composed of a series of small rich panels.

Q. How are the ribbed roofs formed?

A. Often of timber and plaster—generally colored to represent stone works.

Q. In describing the several styles, is there not a probability of mixing one with the other?

A. Yes; as one style gradually passed into another, there will be here and there buildings partaking of two. Litchfield cathedral is a fine instance of the gradation from richer early English into decorated English. There are also many beautiful gradations from decorated to perpendicular, as exemplified in the choir, York.

Q. What is to be observed on the alterations and additions which most ecclesiastical edifices have received, in judging of their age?

A. The general alteration is that of windows, which is most frequent. Very few churches are without some perpendicular windows; and it may therefore be concluded that the building is as old as the windows, or that part connected with the window. Doors cannot so well be distinguished, being often left much older than the rest of the building.

Q. What also is to be observed on the locality of styles?

A. It is perceptible in every country. Where flint abounds, it is difficult to determine the date of churches, having no battlements, arches, or buttresses. Where stone is used, there is a sufficient criterion to determine on the style. Due attention to correct plates, and habitual observation, will enable the connoisseur to determine the era of every edifice.

Q. What building of the fifteenth century deserves particular notice?

A. Roslyn's chapel at Woodstock. It is singular in its character, ornaments, and plan, and is unclassable as a whole, being unlike any other in Great Britain. The ornamental work completely accords with the style then prevalent, though debased by the clumsiness of the parts, and the want of proportion to each other. No doubt but it was designed from some foreign building.

ELIZABETHIAN STYLE.

Q. What style intermediate the latter part of the fifteenth and the commencement of the sixteenth century calls forth attention?

A. The Elizabethian style—partaking of the four precursory styles, yet claiming an originality of its own.

Q. What are the prominent features of this style?

A. The square panelled mullioned windows, and wooden panelled roofs of walls. This style, however, appears to be confined principally to domestic habitation rather than ecclesiastical edifices.

Q. What is the character of these buildings?

A. The walls are generally of brick, finished with battlements, angular, semi-circular, and compound pediments. In many instances each story is corbelled one over the other. The roofs are high pitched, containing chequer or spandril windows. The apertures for windows are very large, as also the doorways. The interior arrangements of these buildings approximate more to domestic comfort, representing the capacious homely hearth; whilst the wooden panelling, with carved devices, enclose the naked walls. The introduction of oak and deal flooring substitutes that of stone.

Q. Where is this description of building to be found?

A. In ancient cities and towns, but more particularly amongst the mansions of the great scattered throughout the country, and rising amidst woods, on hills, and in dales, with their ivy-clad walls, so enchantingly, that even modern architecture, in its most splendid attire, succumbs to the antique form, in commemoration of the good and happy days of yore.

GRECIAN AND ROMAN ARCHITECTURE.

Q. At what period was the antique, or Grecian and Roman architecture, introduced into England?

A. In the time of James I., 1626.

Q. How was it introduced?

A. First, only in columns of doors—afterwards, in large portions.

Q. Where is the most memorable specimen?

A. In the celebrated portico of the schools at Oxford, where a building, adorned with pinnacles, having mullioned windows, has the five orders introduced over each other.

Q. What marks the complete introduction of the antique workmanship?

A. The Banqueting House, at Whitehall, and at the close of the seventeenth century this splendid architecture was finally estab-

lished in one of the most magnificent modern metropolitan buildings we possess.

Q. What is to be understood by the word *order*, as applied to the Grecian and Roman architecture?

A. It is so denominated from the different ornaments peculiar to each production. The number of columns, windows, &c. may be the same in either order, only varied in proportion.

Q. How are the orders generally considered?

A. To be five: *Tuscan*, *Doric*, *Roman*, *Corinthian*, and *Composite*; to which may be added the *Roman Doric*, and the *Roman Ionic*.

Q. How are these orders distinguished?

A. The *Tuscan*, quite plain; the *Doric*, by the triglyphs in the frieze; the *Ionic*, by the ornaments of its capital, termed volutes; the *Corinthian*, by the superior height of its capital, and ornamental leaves; the *Composite*, by the large volutes of the Ionic capital; the *Roman Doric*, by the triglyphs, metopes, and mutules; and the *Roman Ionic*, by the volutes of the capital. In short, the capitals wholly denote the orders.

Q. How is a complete order divided?

A. Into three grand divisions, which are occasionally executed separately. First, the column, including its base and capital; second, the pedestal, which supports the column; and third, the entablature, or part above, supported by the column.

Q. How are these subdivided?

A. The *pedestal*, into *base* or *lower mouldings*; the plain central space, into *dado* or *die*; and the upper mouldings, into *surbase*. The *columns*, into *base* and *lower mouldings*; *shaft*, or central plane space; and *capital*, or upper mouldings. The *entablature*, into *architrave*, or part immediately above the column; *frieze*, or central flat space; and *cornice*, or upper projecting mouldings.

Q. How are these parts again subdivided?

A. First, the lower portions, viz. base of pedestal, base of column, and architrave, divided each into two parts: the first and second into plinth and mouldings, the third into faces and upper moulding, or tenia. Second, each central portion, as dado of pedestal, capital of column, and cornice of entablature, divides into three parts: 1st, into *bed-mould*, or part under the corona; 2d, *corona*, or plain face; 3d, *cymatium*, or upper moulding. Third, the *capital*, into *neck*, or part below the ovolo, or projecting round moulding, and *abacus*, or tile, the flat upper moulding, mostly nearly square. These divisions of the capital, however, are less distinct than those of the other parts. Fourth,

the *cornice*, into *bed-mould*, or part below the corona; *corona*, or flat projecting face; *cymatium*, or moulding above the corona.

Q. What are the ornamental mouldings round windows and doors designated?

A. *Architraves*.

Q. What is the ornamental moulding from which an arch springs called?

A. The *impost*.

Q. What is the stone at the top of the arch?

A. A *key-stone*; and the ornament carved on it a *console*.

Q. What are the small brackets under the corona in the cornices?

A. *Mutules*, if square or longer in front than in depth; as used in the *Doric* order. If less in front than their depth, *modillions*, and have carved leaves under them, as in the *Corinthian* order.

Q. What is a *truss*?

A. A modillion enlarged and placed flat against a wall, to support cornices. When used under modillions, in the frieze, trusses become *cantilivers*.

Q. What is the *soffit*?

A. The space under the corona of the cornice; also, the under side of an arch.

Q. What are *dentils*?

A. Ornaments used in the bed-moulds—parts of a small flat face cut perpendicularly, and spaces left between each.

Q. What is the *Attic order*?

A. A minor order invented by the Atticæ, a people of Greece; it consists of short pilasters, forming a small height of panelling above the grand entablature, and is again raised on the summit, which forms an architrave cornice. These panels have, sometimes, introduced between them small pillars, designated *balustres*; a series of them form a *balustrade*.

Q. What is the *Persic order*?

A. It is delineated by columns, constructed in the form of men, supporting an entablature, and is said to have originated from Pausanias defeating the Persians, when the Lacedæmonians, as a mark of victory, erected trophies of the arms of their enemies, and represented the Persians under the figures of slaves, supporting porticos, arches, or houses.

Q. Of what order is the *Caryatides*?

A. The columns are in the form of women with their arms cut off, and with garments reaching down to their feet. This order arose from the inhabitants of Carya, in Peloponesus, having joined the Persians against their own countrymen. The Greeks were totally defeated. The victors put the men to the sword, and carried off the women

in triumph ; and the more to perpetuate this action, they represented these women, in their triumphal vestments, supporting the heavy weight of edifices.

Q. What are *Termini* ?

A. Figures of human heads, without feet or arms. Such was the representation of Terminus, a divinity of Rome. His temple was on the Tarpeian rock ; he presided over land marks, and is thus represented, intimating that he never moved, wherever he was placed.*

Q. What is a *pilaster* ?

A. A flat column of the same proportions as the circular columns, and decorated in like order, presenting itself one quarter of its thickness from the surface of the wall, and used for convenience and economy. Those, however, which have a different capital are called *antæ*, and are undiminished.

Q. What are *pediments* ?

A. Flat angular spaces of masonry, surmounting the columns and entablatures of the portico, and have cornices containing either mutules, modillions, or dentils. Such in the raking cornice must be placed perpendicular over the like in the horizontal line ; and their sides perpendicular, though their under parts have the rake of the cornice. The interior part is sometimes *grouped*.

Q. What are the joints of masonry channelled termed ?

A. *Rustic work*, or rusticating.

Q. How are columns ornamented ?

A. Sometimes by channels, termed *flutes* ; these channels are partly filled by a lesser round moulding, which is known as *cabling* the flutes.

Q. What are the different mouldings which, by different combinations, form the several parts of the orders ?

A. *Ovolo*, or quarter round ; *cavetto*, or hollow ; *torus*, or round. These are the most simple, and from the composition of them are formed divers others ; and from an arrangement, with plain flat spaces between, are formed cornices and other ornaments.

Q. What is a large flat space designated ?

A. A *corona*, if in the cornice ; a *fascia*, if in the architrave. The frieze itself is only a flat space.

Q. What is a small flat space termed ?

A. A *fillet* or *listel* ; and interposes mouldings to distinguish them. A fillet is, in the base of columns and some other parts, joined to a face, or to the column itself, by a small hollow then called *apophyge*.

Q. What is an *astragal* ?

A. The torus, when it becomes very small, and projects. And the torus is a *bead* when it does not project.

Q. What are *compound mouldings* ?

A. The *cima recta*, which has the round lowermost, and projecting ; the *cima reversa*, or ogee, which has the round uppermost, and projects*—the *scotia*, which is formed of two hollows, one over the other, and of different centres.

Q. What are *reedings* ?

A. Several beads sunk on a flat face.

Q. What are *enrichments* ?

A. All these mouldings, except the fillet, when they are carved.

Q. What is the difference between the Grecian mouldings and those of the Roman ?

A. Those of the former are bold and worked with a small return, technically termed a *quirk*, and are of various proportions ; whilst the mouldings of the latter are generally worked of equal projection to the height, and not bolder than above regular forms. The ogee and ovolo are most generally used.

Q. How are the several orders, with their component parts, proportioned ?

A. Vignola, with a view of preventing those mistakes which often arise from the different measures which, in different nations, bear the same name, invented a mode of division, termed *module* (from *modulus*, signifying measure, due proportion,) and a measure now used by all architects.

Q. What are the proportions ?

A. The module of the Tuscan and Grecian Doric is equal to *one half* the diameter of the bottom of the shaft, which module is subdivided into *thirty minutes*. The module of the Ionic, Corinthian, and Composite, is equal to the whole diameter of the bottom of the shaft, and is subdivided into *sixty minutes*.

CAST IRON PUMPS.—The following drawing represents a pump about two and a half feet high, and is designed for cisterns, particularly in kitchens, barns, green-houses, and other out buildings. The pump may be placed within the building, and the water drawn from a cistern without the building by the aid of a bended tube of copper or lead. The following are the directions for setting and using.

Unscrew the three screws in the bottom of

* These three orders of figures are seldom used but in mantel-pieces, or as *trusses*, to support cornices to monuments, and for gardens. The two former, however, are introduced into one of our modern edifices of religion.

* The moulding under the cymatium, which in rich orders is often an ogee, is part of the corona, and as such is continued over the corona in the horizontal lines of pediments, where the cymatium is omitted ; and is also continued with the corona in interior work, where the cymatium is with propriety omitted.



the pump, and it will then be separated into three parts.

After placing the pipe into the well, carry the other end through the floor and sink, or where you wish the pump to stand; then put the bottom plate over the end of the pipe about three-fourths of an inch, and with a piece of wood the shape of an hen's egg, you will easily bend the lead into the place left in the plate for it; then hammer it down level with the top of the plate, and screw down the plate with wood screws, placing a piece of leather or cloth under the plate to make it tight, if it is set in the bottom of the sink; then place the leather valve and pump as you took them apart, and screw them together tight, after having wet the leather in warm water.

The pipe should be placed a little descending from the sink to the well, so that the water will run out freely when necessary. This pump is so constructed, that by raising the brake clear up, the valves are opened, and the water passes off immediately out of the pump and pipe, which operation is necessary in cold weather to prevent it from freezing.

Manufactured by Scott, Keith & Co., East Bridgewater, Mass., Patentees, and sold by H. Huxley & Co. 81 Barclay street, New-York. Price, small size \$8; large size \$10.

THE ENJOYMENT OF READING.—We said a word or two on this subject in our preceding volume; and on account of its great importance to every individual, we cannot help again advert to it. We recommend those who have not taken the *Penny Magazine* from its commencement, at least to purchase No. 95, for September 28, 1833. It is most gratifying to reflect that there is not a human being, endowed with health and the ordinary condition of the human faculties, that may not participate in what Sir John Herschel appears to

consider the greatest of human pleasures. It is delightful to foresee that, when the whole of society shall be so far educated as to derive pleasure from reading, and when books are as common as bread and potatoes, the hardest-worked agricultural laborer or mechanic, when he goes home from his day's toil, may plunge at once into intense enjoyment by taking up a book. The most gratifying circumstance respecting this enjoyment is its universality, and its applicability to all countries, all future ages, and to every human being in tolerable health and above destitution. It is equally applicable to man, whether in prosperity or in adversity; whether in prison or free; and even, to a certain extent, whether in health or sickness. Another gratifying prospect anticipated from the result of universal reading is, universal improvement of worldly circumstances. Let any taste become general, and the regulations and habits of society will accommodate themselves to that taste. The hours of labor, at present, afford barely time for eating and sleeping; but when reading becomes a necessary of life to every, even the lowest, class of society, they will be reduced so as to afford time for that enjoyment also. Surely, if nothing else were to be gained by a system of national education, but the power of conferring so much happiness on millions, it would deserve the patronage of every benevolent mind, and be worthy the adoption alike of governments professing to be paternal or to be representative. But the main object which we have now in view is to impress Sir John Herschel's statement strongly on the mind of the young mechanic, so as to encourage him, above all other earthly things, to cherish a taste for reading in himself, and in all those with whom he may have any thing to do. Another point to which we wish to direct attention is the necessity, when a national system of education is established, of adding to every school, not only a garden, a workshop for teaching the simpler operations of the mechanical arts, and a kitchen for teaching the girls cookery, but also a circulating library for the benefit of the whole parish. In furtherance of these objects, we cannot resist giving the following short extract from Sir John Herschel's address: "Of all the amusements which can possibly be imagined for a hard-working man, after his daily toil, or in its intervals, there is nothing like reading an entertaining book, supposing him to have a taste for it, and supposing him to have the book to read. It calls for no bodily exertion, of which he has had enough, or too much. It relieves his home of its dullness and sameness, which, in nine cases out of ten, is what drives him out to the alehouse, to his own ruin and his family's. It transports him into a livelier, and gayer, and more diversified and interesting scene; and, while he enjoys himself there, he may forget the evils of the present moment, fully as much as if he were ever so drunk, with the great advantage of finding himself the next day with his money in his pocket, or, at least, laid out in real ne-

cessaries and comforts for himself and his family,—and without a head-ach. Nay, it accompanies him to his next day's work; and, if the book he has been reading be any thing above the very idlest and lightest, gives him something to think of besides the mere mechanical drudgery of his every-day occupation,—something he can enjoy while absent, and look forward with pleasure to." . . . "If I were to pray for a taste which should stand me in stead under every variety of circumstances, and be a source of happiness and cheerfulness to me through life, and a shield against its ills, however things might go amiss, and the world frown upon me, it would be a taste for reading."—[Penny Magazine.]

INGENIOUS CONTRIVANCE.—I wish, through the medium of the Centinel and Palladium, to notice a neat and economical improvement made by Mr. Currier, of this city, respecting bells for houses and hotels. Heretofore there have been separate bells for each apartment. These have been numbered to indicate the apartment where an attendant was wanted. In large establishments numerous bells are necessary, and these are costly, and sometimes not useful if the bell had ceased to sound before it was looked at. In the invention a single bell is sufficient for the largest hotel. The wire from each apartment, while it rings this common bell, communicates motion to a suspended ball over an appropriate number, and its long continued vibrations give, without fail, and without noise, the information that is desired. The expense is comparatively trifling.—[Boston Centinel.]

ON THE BURNING OF WATER.—From a recent number of Silliman's Journal, we copy the following respecting the "American Water Burner," which we have several times mentioned. We omit several pages of theoretical reasoning, and confine our extracts entirely to the results.

"The experiments which I have made have proved practically, that an engine with a power equal to driving a boat four miles an hour, and a railroad car twice that distance in the same time, with ten or twelve passengers, may be made for one hundred dollars: and that the engine with its preparing vessel (a substitute for the boiler in the steam engine) need not weigh one hundred pounds—and the expense of working it will not exceed ten or twelve cents per hour. There are certainly no difficulties to be removed. These facts have been verified practically and repeatedly before hundreds of people.

"Some recent improvements in the mode of constructing lamps for burning water, to produce light and heat, have perfected the operation for these purposes. It now carries demonstration in every form. For instance, when you put by one fourth of a gill of spirits of turpentine into the lamp, and as much water, and raise the temperature to less than that of boil-

ing water, the vapor that comes over will be in the ratio of about equal parts of each. If, in the combustion of these vapors, a due proportion of air is mixed and inflamed, it will in a few minutes boil a two quart copper tea kettle. If small brass wire is brought over and in contact with the flame, it instantly drops in pieces—small copper wire is readily melted—fine iron wire, if the proportion be right, is instantly inflamed—and thin sheet copper, with a small piece of silver, or silver soldered on it with borax, being exposed to the same, the silver melts in a few seconds, and the copper very soon; and this is done while the vapor is not concentrated in any way, and issues only with a velocity about the same as that of gas in gas lights.

"This discovery gives every promise of supplying a much cheaper fuel, (as a fuel,) exclusive of a clear saving of light, than any one now in use. It is my intention to introduce my lamps, &c. into use as soon as I conveniently can."

The following remarks by Professor Silliman will show how much importance may be attached to these discoveries:

"We have seen some of Mr. Morey's experiments, and can testify to the correctness of his statements, as regards the great amount of heat and light evolved by combustion of the vapor of water mixed with that of spirits of turpentine, or alcohol, and duly modified by common air. The results are very striking and beautiful, and we can see no reason why they should not prove of great practical utility."

AWFUL CALCULATION.—An ingenious, authentic, and valuable statistical work, published a few years since, states that the number of inhabitants who have lived on the earth amount to about 36,627,843,275,846. The sum, the writer says, when divided by 3,096,000, the number of square leagues of land on this surface of the globe, leaves 11,820,698,732 persons to each square league. There are 27,864,000 square miles of land, which, being divided as above, gives about 1,314,522,076 persons to each square mile. Let the mile be reduced to square rods, and the number he says will be 1,853,500,000, which, being divided as above, gives 1,283 inhabitants to each square rod, which rod, being reduced to feet and divided as above, will give about five persons to each square foot of terra firma on the globe. Let the earth be supposed to be one vast burying ground, and, according to the above statement, there will be 1,283 persons to be buried on each square rod, capable of being divided into twelve graves: it appears that each grave contained 100 persons, and the whole earth has been one hundred times dug over to bury its inhabitants—supposing they had been equally distributed! What an awful, overwhelming thought! What a lesson to the infatuated being who has centered all his hopes and affections upon the evanescent pleasures of this truly transitory life!

THE FIRE OF ADVERSITY.—It was related of the celebrated Dr. Spurzheim, who died in Boston about a year ago, that, in selecting a lady for a wife, he made choice of one who had seen much trouble and had passed through uncommon scenes of calamity. His theory was, that great mental suffering was necessary in the formation of human character, to develop the highest and purest qualities of the soul.

We need not say how well this corresponds with the sacred declaration—"Every son whom he loveth therefore he chasteneth."

It is hard to heave the sigh, to shed the midnight tear, to feel sorrow passing heavily on the naked heart, and such sorrow, too, as we dare not suffer any one but God to look upon; it is hard and bitter, yet, under its chastening influence, it is not for us to say how much the heart beautifies, and the will acquires, the principles of obedience.

Laying aside the considerations of religious improvement, we often see the soul aroused to a strong energy, to the exertion of unwonted power, by the pressure of some kind affliction.

How many deathless works of genius have been forced into being by the iron hand of poverty. Debts, embarrassments, and want, have been the uncongenial, yet creative elements of

poetry and romance. The sweetest songs of the swan are fabled to be exported by the agonies of death.

Let the sufferer who struggles under strange and dreadful dispensations—she who mourns a drunken husband—or he who mourns the solace of his heart immured in an untimely grave—reflect, that affliction only darkens this world that it may brighten the next.

ACTION OF HEAT UPON RAZORS.—It has been asked why, in time of frost, a razor, unless it be warmed, will not cut without irritating the skin? It is because, when it freezes, the edge of a razor, examined by a microscope, is like a saw, and, as soon as warmed, becomes smooth.

ANALYSIS OF OYSTER SHELLS.—One hundred grains of oyster shell will give Carbonate of Lime, 95.18; Phosphate of Lime, 1.88; Silica, 0.40; Water, 1.62; Insoluble animal matter, 0.45; Loss, &c. 0.46. From this view of the composition of recent oyster shell, it is obvious that no appreciable advantage can be expected in applying it as a manure from the minute proportion of animal matter which it has been shown to contain. It is as a carbonate of lime, and that nearly in a state of purity, that it should claim the attention of the agriculturist.—[Farmers' Register.]

METEOROLOGICAL RECORD, KEPT AT AVOYLLE FERRY, RED RIVER, LOU.

For the month of March, 1834—(Lat. 31.10 N., Long. 91.59 W. nearly.)

Date.	Thermometer.			Wind.	Weather, Remarks, &c.
	Morn'g.	Noon.	Night.		
1834.					
March 1	37	63	60	w—light	clear—light white frost—Red River rising, below high water 5 ft. 6 in.
" 2	45	58	51	N	"
" 3	41	57	51	N—light	"
" 4	36	74	58	"	cloudy—white frost—rain at night
" 5	54	66	64	calm	" morning—evening and night clear
" 6	60	73	70	s—light	" all day
" 7	68	75	74	s—high	" —at night heavy rain and thunder
" 8	60	71	55	calm	" —evening and night heavy and steady rain
" 9	48	48	46	N E	" " " " " "
" 10	46	48	49	N E light	" " " " " light and drizzling "
" 11	50	56	55	calm	" —drizzling all day and night
" 12	54	63	62	"	" " " " " "
" 13	59	61	60	"	" —heavy thunder and rain all day—night foggy
" 14	59	61	67	"	" —evening thick clouds, and the sun visible through them
" 15	54	73	68	"	clear all day
" 16	58	74	71	s w	cloudy "
" 17	64	67	65	calm	" —rain
" 18	64	74	70	"	" —evening clear
" 19	64	72	71	s e—light	" —and showers all day
" 20	65	70	65	w	clear all day
" 21	50	65	60	N	" "
" 22	47	64	58	calm	" "
" 23	52	67	66	s	cloudy all day—night clear
" 24	60	74	71	calm	" —rain and heavy thunder showers—night clear
" 25	69	80	72	s w	" —night wind severe, w—planted <i>Beda</i> grass and <i>Gujna</i> grass seed
" 26	54	66	64	calm	" —planted second lot of Irish potatoes and sweet potatoes
" 27	61	66	68	"	" —field of corn, peas, beans, and sowed grass seeds—heavy
" 28	64	70	63	"	" —rain, and heavy thunder showers [rain and thunder
" 29	63	76	72	"	clear all day
" 30	57	78	71	"	" "
" 31	64	79	73	s—high	cloudy morning—clear day

Red River rose this month 2 feet 9 inches—below high water, 2 feet 9 inches.

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